

Edexcel IAL Biology A Level

Core Practical 15

Use an artificial hydrogen carrier (redox indicator) to investigate respiration in yeast.



Independent variable: Temperature

Dependent variable: Time taken for the redox indicator to turn red

Equipment list

- Redox indicator - triphenyl tetrazolium chloride (TTC) solution
- Water baths and refrigerators at the following temperatures - 15°C, 20°C, 25°C, 30°C and 35°C
- Thermometer
- Yeast suspension / dried yeast, glucose and distilled water
- Distilled water
- Pipettes
- Test tubes
- Test tube rack
- Stopwatch
- Stirring rods

Background information

During oxidative phosphorylation in aerobic respiration the hydrogen carriers, such as FAD and NAD, are regenerated by being **oxidised**. In this experiment, the hydrogen carriers are oxidised by a redox indicator (TTC) which is in turn **reduced**, causing a colour change to **red**. The time taken for the colour change to occur can be used to indicate the rate of respiration.

Method

Preparing the yeast -

Add 10g of dried yeast and 50g of glucose to 1000 cm³ of distilled water, mixing thoroughly with a stirring rod. Allow the yeast culture to stabilise for 24 hours before starting the experiment.

1. Set up the first water bath at 35°C
2. Use a pipette to place 10 cm³ of the yeast suspension into one test tube and 1 cm³ of TTC into a different test tube.
3. Place both test tubes into the water bath and leave them for 5 minutes to allow them to **reach the temperature of the water bath**.
4. Quickly pour the TTC solution into the test tube containing the yeast, give it a stir with the glass stirring rod and start the stopwatch.
5. Stop timing once the **solution has turned red** and **record the time taken** in a suitable table.
6. Repeat steps 1-5 with the remaining 4 temperatures.



Risk assessment

Risk	Hazard	Precaution
TTC redox indicator	Potential allergic reaction and could irritate skin and eyes	Avoid skin contact Be careful when handling Do not inhale Wash hands after use
Glassware	Cuts from sharp objects	Take care when handling glass objects Keep away from edge of desk
Liquids	Spillage that could cause surfaces to be slippery leading to an accident	Wipe up any liquid spillages as soon as they occur Put lids on bottles and put them away once used

Results table

Temperature (°C)	Time taken for solution to turn red (seconds)
15	
20	
25	
30	
35	

2 graphs can be plotted from the results table.

- A graph of temperature against time
- A graph of temperature against rate of reaction (calculated using $1 / \text{Time taken}$)

